Outstanding Performance

MOVE AHEAD WITH DUAL-CORE
INTEL® XEON® PROCESSOR-BASED SERVERS

With Intel built in, your company has success built in.

To move forward, your business has to be agile—recreating itself daily to better compete in today's environment. Acting and reacting on the turn of a dime. Taking advantage of innovations at the same time you make the most of your existing technology investment.

That's just what server platforms based on Intel's multi-core technology let you do, giving you outstanding performance and responsiveness, and a foundation based on an industry-leading business computing architecture.

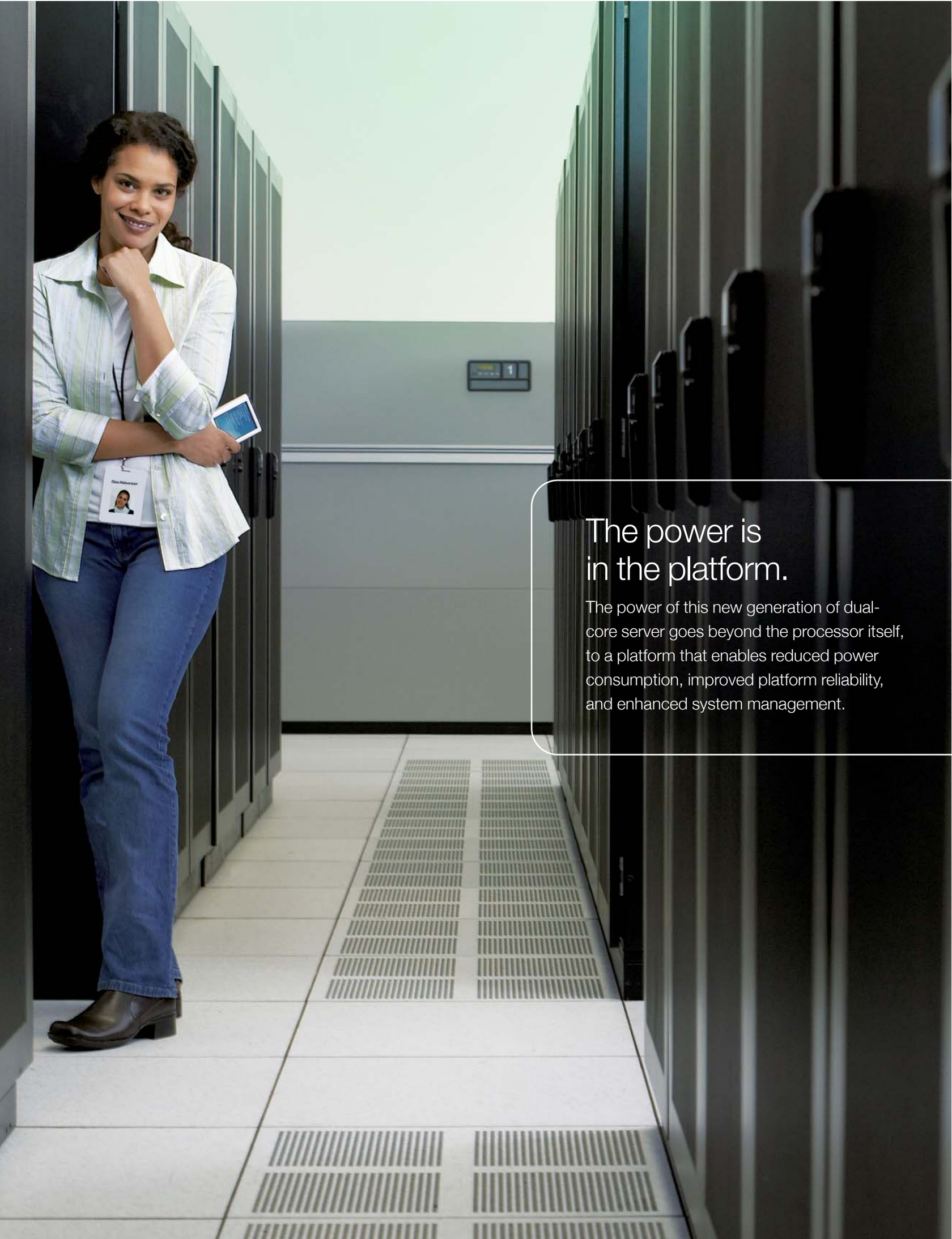
With nearly 30 million Intel® processor-based servers shipped since 1996, and a 20-year track record of delivering enterprise-class performance, you know you can count on Intel to deliver outstanding quality and reliability. And with over six million Intel® 64-bit processors already shipped, you can depend on Dual-Core Intel® Xeon® processor-based servers to handle your 32-bit and 64-bit applications.

The world's most widely deployed server platform gets even better with dual-core technology.[1]

Fully 64-bit, servers based on the Dual-Core Intel® Xeon® processor help give you the price, scalability, security, and flexibility you need. And now Intel's first dual-core processor for DP platforms can provide performance gains of up to 50%[2] compared to previous single-core platforms tested. By enabling enhanced performance and more efficient simultaneous processing of multiple tasks, dual-core processors can dramatically increase your server's capabilities and computing resources—helping to give you better responsiveness, higher multithreaded throughput, and the benefits of parallel computing in enterprise applications.

In addition, this new server platform helps reduce power consumption with a host of technologies from DDR2-400 (up to 40% lower memory power than DDR 333[2]) to Demand-Based Switching[5], which reduces power consumption dynamically based on CPU utilization.


Servers based on the
Dual-Core Intel® Xeon®
processor 2.80 GHz
take 64-bit computing
to a new level.



The power is in the platform.

The power of this new generation of dual-core server goes beyond the processor itself, to a platform that enables reduced power consumption, improved platform reliability, and enhanced system management.

Invest in the future.

By investing in dual-core server platforms today, you're investing in the future of computing.

Intel recognizes that the need for platforms with the right type of compute power and performance will continue to escalate over time. The evolution is likely to include better recognition applications and search functions that enable seamless mining of information and support knowledgeable, data-based decision making.

As these and other emerging consumer and business usage models become mainstream, they will require increasingly more compute power. A comprehensive threading strategy that advances the platform—through Hyper-Threading Technology[3] (HT Technology), dual-core processors, and eventually multi-core processors—is crucial to delivering this power.

Intel has been driving toward parallelism for more than a decade: first with multiprocessor platforms and then with HT Technology. Going forward, Intel plans to continue to focus its efforts on technologies that help make the balanced platform a reality—introducing a new era of server performance and flexibility. The increased parallelism allows dual-core platforms to better handle complex, simultaneous transactions and escalating workloads, compared to prior-generation single-core platforms.

A platform that can handle the toughest multithreaded applications.

Server platforms based on the new Dual-Core Intel Xeon processor 2.80 GHz are the ideal solution for multithreaded and multi-task usage environments. Based on the widely deployed Intel® E7520 chipset, these processors can provide performance gains of up to 50%[2] compared to single-core platforms tested and are backwards-compatible with all 64-bit Intel Xeon processors.

For more information on performance, please visit www.intel.com/performance/server/xeon

Dual-core processing enables simultaneous computing.

In today's usage environment, processor speed alone is not enough. That's why Intel® dual-core processors have two complete execution cores in one processor package, running at the same frequency and each supporting HT Technology. Both cores share the same packaging and the same interface with the chipset memory, however, they each have their own set of registers and cache, which manage four threads per core simultaneously (eight threads total). This allows them to deliver exceptional functionality and performance, especially when running multithreaded applications.

Increase performance with an expanded level 2 (L2) cache

Experience faster response times with 2x2MB L2 cache. Because programs frequently use a subset of instructions or data repeatedly, the larger L2 cache helps provide higher performance in many server benchmarks than prior-generation single-core platforms.

Enhance performance for data-intensive applications with PCI Express*

With the increase in the compute performance of Dual-Core Intel Xeon processors, the I/O (input/output) rate at which data can be supplied to the processor increases correspondingly. As processors become faster, the rate at which data needs to be supplied increases. In demanding computing situations, users running compute- and I/O-intensive applications may bump up against the maximum usable bandwidth afforded by PCI-X.* Without sufficient memory bandwidth, the processor can sit idle, waiting for data to be transferred, may affect system performance. At the same time, the industry is transitioning from a parallel I/O (e.g., SCSI, ATA) towards a serial I/O (e.g., SATA, SAS) interconnect infrastructure.

A new serial I/O technology foundation is required to match the performance and capabilities of these next-generation serial interconnects. PCI Express* is the answer to both of these issues.

PCI Express is architected to have lower memory and I/O latency compared to PCI. PCI Express is also capable of higher bandwidth compared to today's PCI or PCI-X solutions. Higher bandwidth means more data can be transferred in the same unit of time. A PCI Express x1 ("by 1") link has a bi-directional peak bandwidth of 500 MB/s, while x4 and x8 links are capable of 2 GB/s and 4 GB/s, respectively. The lower latency and the increased bandwidth help deliver the data speed required to fully utilize the processor's capabilities.

Platform Feature	User Benefit
Dual-Core Intel® Xeon® processor	Provides two execution cores in one physical processor, allowing the platform to do more in less time
2x2MB integrated L2 cache	Each processor core is equipped with its own 2MB cache, allowing the execution cores to quickly access data for processing and reducing the amount of system bus traffic
Intel® Extended Memory 64 Technology[4] (Intel® EM64T)	Enhances Intel® Architecture platforms with 64-bit computing and related instructions, allowing flexibility for 64-bit and 32-bit applications and operating systems
Demand-Based Switching[5] with Enhanced Intel SpeedStep® technology	Helps reduce average system power consumption and potentially improves system acoustics
PCI Express* serial I/O	• Next-generation I/O capable of up to 8 GB/s peak bandwidth • Improved RAS features compared to PCI-X* • Lower latency compared to PCI-X for improved I/O performance • Software compatible with PCI-X to simplify parallel-to-serial transition
DDR2-400 memory	• Provides up to 20% increase in memory bandwidth over DDR 333 • 40% lower power consumption vs. DDR 333 • Increased DIMMs per system for enhanced memory scalability
Enhanced reliability and manageability	• Many memory controller features, together with PCI Express RAS features combine to improve platform reliability vs. previous-generation platforms • The Intel® E7520 chipset includes an SMBus port for remote management operation and support for a variety of third-party BMC (base management controller) and BIOS solutions
Streaming SIMD Extensions 3 (SSE3) instructions	Better multimedia and encryption/decryption processing than previous generation, along with support for more computationally intensive graphics
Hyper-Threading Technology[3]	Allows each core to function as two logical processors providing for better compute throughput when used with threaded applications. Improves processor utilization and system responsiveness for better user experience compared to previous generation.
800 MHz system bus	Provides excellent platform bandwidth in conjunction with DDR2-400 memory and PCI Express I/O and graphics

Current legacy PCI-X adapters can still be used while transitioning to new I/O adapters that take advantage of the inherent benefits of this new serial I/O technology.

With the Intel E7520 chipset, PCI Express adapters have a direct path to either chipset's memory controller instead of having to go through a separate bridge component. With the direct attach to the memory controller, two stages are removed. This implementation helps minimize the latency between the I/O adapter and the memory controller for improved I/O performance.

In addition to the many benefits of PCI Express, it is also a common I/O interface for mobile, desktop, workstation, storage, and network technologies. This results in economies of scale, which in turn rapidly helps drive down the cost of PCI Express solutions.

And as the industry transitions from a parallel to a serial I/O infrastructure, users can confidently invest in new DP server platforms supporting PCI Express technology. With their scalable architecture, these platforms provide a smooth upgrade path to 10 Gigabit-based technologies.

Save on power costs using Demand-Based Switching[5] (DBS) with Enhanced Intel SpeedStep® technology

Demand-Based Switching technology enables platform and software power management features to lower average power consumption while maintaining application performance. It can help reduce average CPU power consumption with minimal performance impact.[5]

The processor's operational states can vary based on usage. So when utilization is high and maximum performance is desired, the processor can be switched to a higher operational state automatically. When usage is lower, transitioning to a lower operational state helps lower the average power consumption while maintaining application performance. There is even a state for maximum power conservation during system idle periods. Not only are power consumption levels reduced during lower operational states, but system acoustics can also be lowered by slowing down or halting fan operation entirely.

Help improve security and reduce virus-related repairs with Intel's Execute Disable Bit functionality

Malicious buffer overflow attacks pose a significant security threat to your business, increasing your IT resource demands and in some cases destroying data. In a typical attack, a malicious worm creates a flood of code that overwhelms the processor, allowing the worm to propagate itself to the network and other computers. The Intel® Execute Disable Bit functionality can help prevent certain classes of known malicious "buffer overflow" attacks when combined with a supporting operating system.

Execute Disable Bit allows the processor to classify areas in memory by where the application code can execute and where it cannot. When a known malicious worm attempts to insert code in the buffer, the processor disables code execution, helping to prevent damage or worm propagation.

Replacing older computers with Execute Disable Bit-enabled systems can help halt certain known worm attacks, helping to reduce the need for virus-related repairs. In addition, Execute Disable Bit may help reduce the need for software patches aimed at buffer overflow attacks.

Execute Disable Bit currently requires one of the following operating systems:

- Microsoft Windows* Server 2003 with Service Pack 1
- Microsoft Windows XP* with Service Pack 2
- SUSE Linux* 9.2
- Red Hat Enterprise Linux* 3 Update 3

See the Microsoft Windows Service Pack Roadmap for more information on Service Pack releases, or download Windows XP Service Pack 2.

Multi-task more effectively with HT Technology

HT Technology is a groundbreaking technology that boosts computing performance to help keep pace with today's applications and operating systems. HT Technology enables a single processor to function as two "virtual" processors by executing two threads in parallel, allowing you and your software to multi-task more effectively than ever before.

Increase responsiveness with Streaming SIMD Extensions 3 (SSE3) instructions

Thirteen SSE3 instructions are fully supported by the Dual-Core Intel Xeon processor. Two of the instructions can improve thread synchronization over the previous-generation processor supporting SSE2 technology. This helps to increase processor utilization, enhance Hyper-Threading performance, and increase system responsiveness.

Increase bandwidth and lower power consumption with DDR2-400 memory

With the increase in processor bandwidth, it's important to have faster, dual-channel memory designs that can keep up. DDR2-400 memory provides better memory bandwidth and reduced latency compared to older DDR 333 memory, and the power generated is lower by up to 40%, which helps reduce the overall system power requirements.

Enterprise servers that require large memory configurations—such as those employing Intel® Extended Memory 64 Technology[4] (Intel® EM64T)—also benefit as the total power generated is reduced in comparison with DDR technology.

Intel-based servers currently support more than 20 operating systems and thousands of applications, all validated and optimized for high-availability, performance, and reliability.

Reduce your IT help desk costs with enhanced reliability and system management.

As you know, system hardware is only a small fraction of the TCO. Industry surveys indicate that approximately 70% or more of TCO is attributable to the people who administer and maintain the hardware. One way to reduce TCO is by improving system manageability.

Incorporating the best thinking from the broadest base of industry hardware, software, and integration leaders, Intel's world-class server solutions help you lower your TCO versus prior-generation platforms. With over 170,000 registered solution developers in the Intel community, you can be sure that Intel-based servers have the widest software application compatibility. In fact, Intel-based servers support a wide variety of operating systems and thousands of applications, all validated and optimized for high-availability, performance, and reliability. Also take advantage of built-in advanced security features to help improve uptime and avoid unplanned costs. How to extend the value of your server investments? With solutions offered from over 20,000 vendors worldwide, you can adopt a flexible approach to growth and change with stable and long-lasting solutions built on Intel® platforms.

Manage software across heterogeneous systems

The Intelligent Platform Management Initiative (IPMI) is an open hardware-management interface that uses a standardized message-passing interface. IPMI helps enable management software interoperability in a heterogeneous hardware environment.

The Intel E7520 chipset includes an SMBus port that supports multiple third-party base management controller (BMC) and firmware solutions. Support for multiple third-party solutions not only provides flexibility and customer choice, it also represents a significant advancement in management software interoperability, greatly simplifying system management.

IPMI helps enable management software that works across heterogeneous server system hardware via:

- Instrumentation in server motherboard hardware
- Standards-based architecture for systems and asset management
- Interoperability between hardware and software management
- Increased reliability through a hierarchy of sensors that report alerts to remote consoles
- Common architecture that applies to the 3-tier server architecture prevalent in modern datacenters
- Reduction in the TCO and administration with the use of common software user interfaces across multiple servers from multiple vendors

Reduce downtime with enhanced memory protection

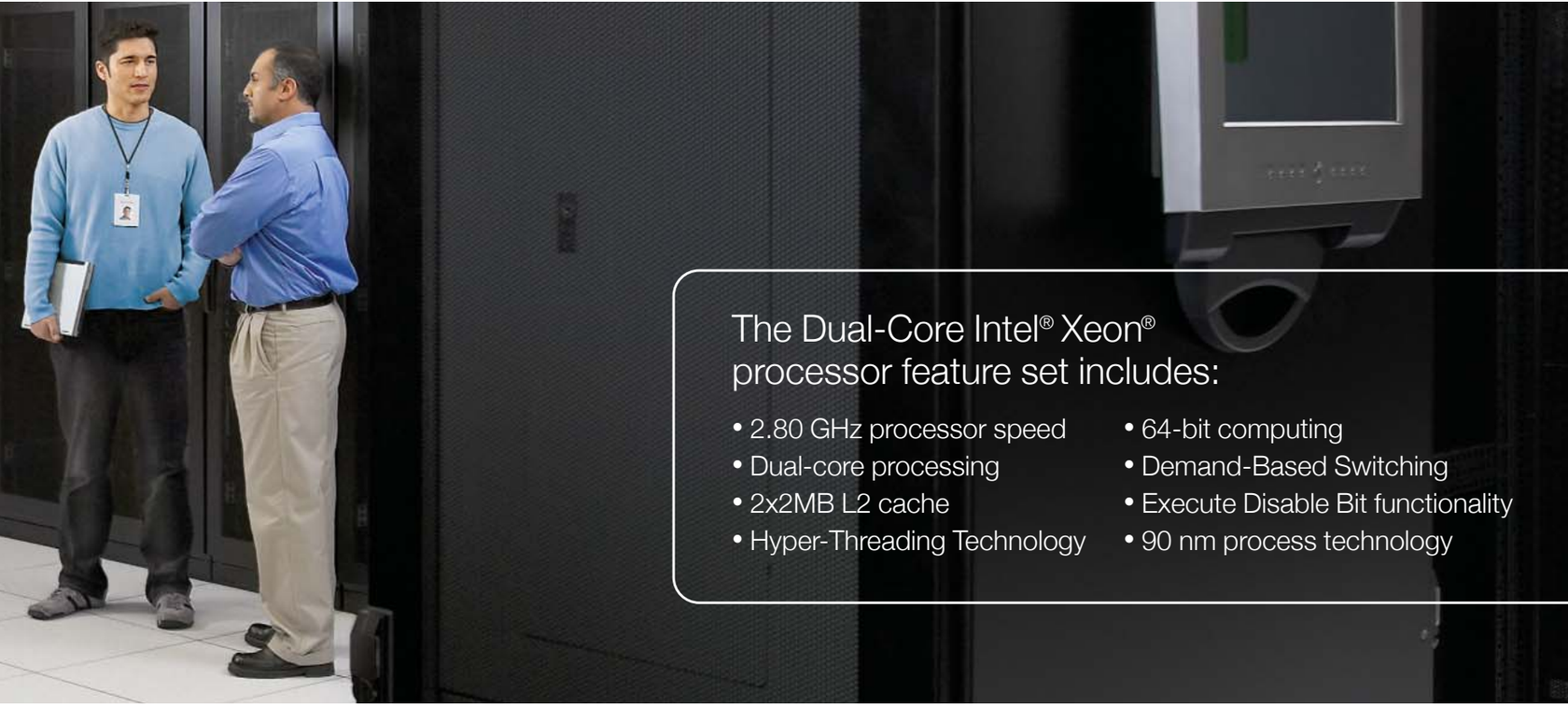
With the rapid price decline of memory, there has been an increase in the amount of memory usage in systems. With more memory in use, the potential for memory failure increases, which increases the importance of memory reliability features in the platform. New Intel Xeon processor-based server platforms offer increased reliability over previous platforms through new features implemented in the chipset memory controller:

- Memory scrubbing: The system constantly tests the memory for soft failures. When a failure is detected, a warning can be issued or spare memory can be invoked to help ensure continued operation.
- Memory mirroring: Two copies of the memory's content are kept. If one set of memory fails, the other set enables continued operation and system availability.
- On-line spare memory: Reserved memory can be invoked and brought online when there is a failure in the memory currently in use.
- Dual-channel failover to single-channel operation: If memory in one of the two memory channels fails, the system can fail-over to single-channel operation, allowing continued system availability until the failed memory can be replaced.
- x4 Single Device Data Correction (x4 SDDC): In a x4 DDR2 or DDR memory device, the Intel® x4 SDDC provides error detection and correction for 1 to 4 data bits within a single device or error detection for up to 8 data bits within two devices.

PCI Express Reliability/Availability/ Serviceability (RAS) features keep you up and running

PCI Express is rich in RAS capabilities:

- Built-in clocking for Data Integrity Checking
- Advanced error logging and reporting through IPMI
- Hot-plug[6] capability simplifies replacement of failed devices and reduces system downtime, while allowing mix and match of peripherals and systems or I/O chassis from different vendors
- A high-performance yet cost-effective RAID can be implemented on the server board using the Intel® IOP332 I/O processor, designed to connect directly to the chipset's memory controller via PCI Express

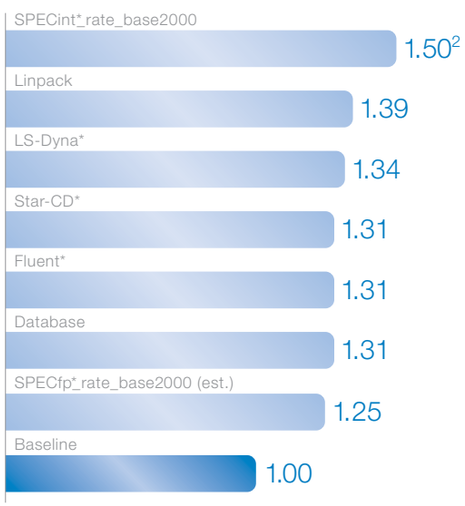


The Dual-Core Intel® Xeon® processor feature set includes:

- 2.80 GHz processor speed
- Dual-core processing
- 2x2MB L2 cache
- Hyper-Threading Technology
- 64-bit computing
- Demand-Based Switching
- Execute Disable Bit functionality
- 90 nm process technology

Dual-Core Intel® Xeon® Processor 2.80 GHz[7]

Dual-core platform versus prior-generation single-core platform



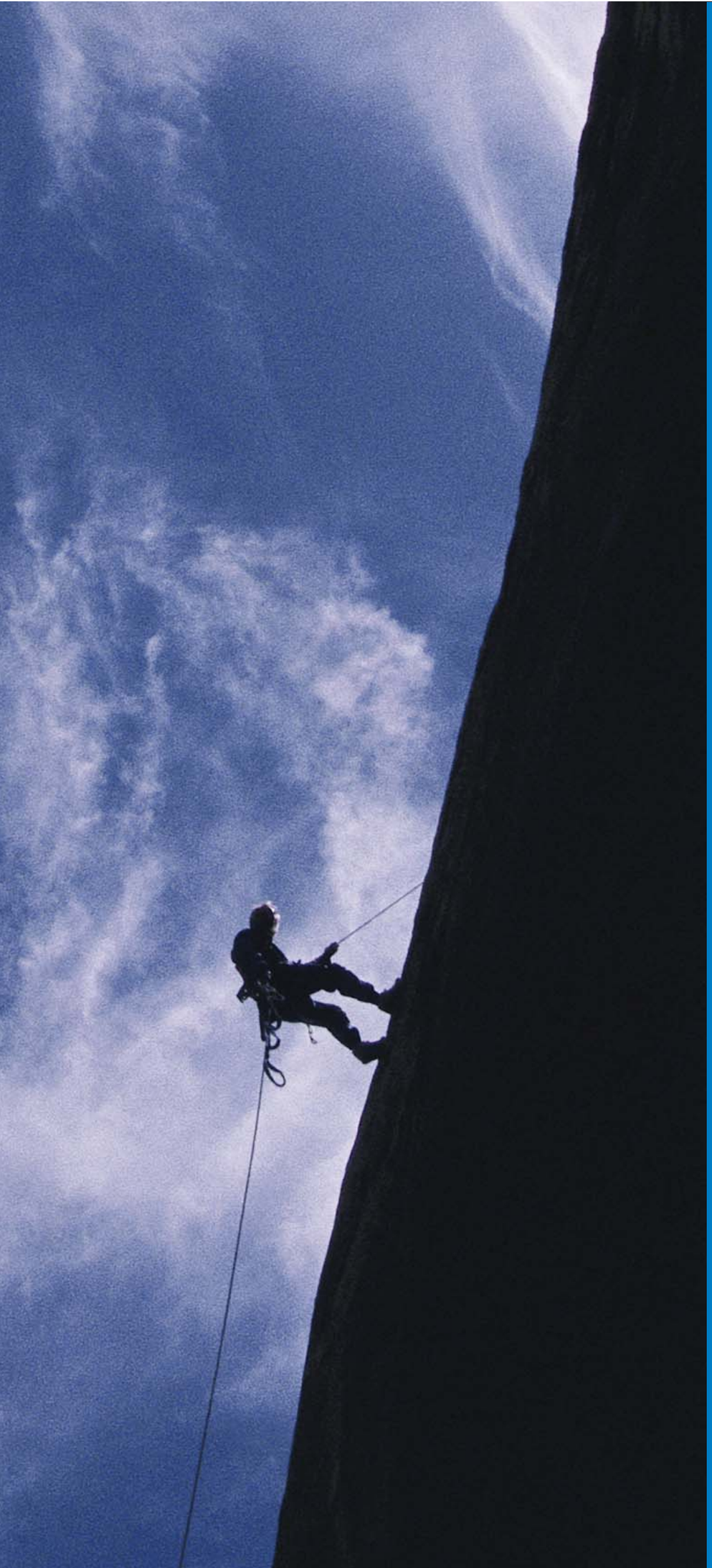
DATA SOURCE: Published results/Intel internal measurement, Q4 2005
Relative performance—higher is better.

- Both platforms utilize Intel® E7520 chipset and 800 MHz system bus
- Dual-core processor: Dual-Core Intel® Xeon® processor 2.80 GHz
- Single-core processor: Intel® Xeon® processor 3.60 GHz with 2MB L2 cache

Dual-core processing can provide up to 50%[2] performance gain.

With Intel built in, your company has success built in.

Server platforms based on the Dual-Core Intel Xeon processor 2.80 GHz and the Intel E7520 chipset deliver outstanding computing power and flexibility. In addition, these new platforms, backed by the Intel Xeon processor brand, offer optimized power consumption, plus improved platform reliability and manageability compared to previous-generation server platforms to further help lower TCO and maximize your return on investment.



Find out more

about Dual-Core Intel® Xeon®
processor-based server platforms
at **www.intel.com/xeon**

[1] Source: IDC Tracker, August 2005.

[2] Performance gain based on result submitted to www.spec.org on SPECint*_rate_base2000 benchmark. Baseline System Configuration: IBM eServer* xSeries* 346 Server platform with two 64-bit Intel® Xeon® processors 3.60 GHz with 2MB L2 Cache and 800 MHz system bus 8x512MB ECC PC2-3200 DIMMs for RAM and Windows* 2003 Standard Edition for OS. Intel Compiler 8.1 binaries. For more information see http://www.spec.org/cpu2000/results/res2005q2/cpu2000-20050514-04113.html. **New Platform Configuration:** IBM eServer* xSeries* 346 Server platform with two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2MB L2 Cache 800 MHz system bus, 4 GB DDR2, Microsoft Windows Server* 2003, standard Edition, Intel C/C++ Compiler 9.0 (20050624Z) for 32-bit applications, Intel Fortran Compiler 9.0 (20050624Z) for 32-bit applications, Microsoft Visual Studio .NET* 13.0.9466 (for libraries) MicroQuill Smartheap Library* 7.30 Submitted to www.spec.org for review as of Oct 10, 2005. For additional information on other applications tested and benchmark results see http://www.intel.com/performance/server/xeon/index.htm. Results vary by hardware and software configuration.

[3] Hyper-Threading Technology requires a computer system with an Intel® Xeon® processor supporting Hyper-Threading Technology and an HT Technology-enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. See http://www.intel.com/info/hyperthreading/ for more information including details on which processors support HT Technology.

[4] Intel® EM64T requires a computer system with a processor, chipset, BIOS, OS, device drivers and applications enabled for Intel EM64T. Processor will not operate (including 32-bit operation) without an Intel EM64T-enabled BIOS. Performance will vary depending on your hardware and software configurations. Intel EM64T-enabled OS, BIOS, device drivers and applications may not be available. Check with your vendor for more information.

[5] Actual power savings will vary based on system configurations and workloads.

[6] Memory mirroring and PCI Express* Hot Plug are supported on the Intel® E7520 chipset only.

[7] **Benchmark notes:**

Performance gain based on result submitted to www.spec.org on SPECint*_rate_base2000 benchmark. Baseline System Configuration: IBM eServer xSeries 346 Server platform with Two 64-bit Intel® Xeon® processors 3.60 GHz with 2MB L2 Cache and 800 MHz system bus 8x512MB ECC PC2-3200 DIMMs for RAM and Windows 2003 Standard Edition for OS. Intel Compiler 8.1 binaries. For more information see http://www.spec.org/cpu2000/results/res2005q2/cpu2000-20050514-04113.html. **New Platform Configuration:** IBM eServer xSeries 346 Server platform with Two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2MB L2 Cache 800 MHz system bus, 4 GB DDR2, Microsoft Windows Server* 2003, standard Edition, Intel C/C++ Compiler 9.0 (20050624Z) for 32-bit applications, Intel Fortran Compiler 9.0 (20050624Z) for 32-bit applications, Microsoft Visual Studio .NET 13.0.9466 (for libraries) MicroQuill Smartheap Library 7.30 Submitted to www.spec.org for review as of Oct 10, 2005. For additional information on other applications tested and benchmark results see http://www.intel.com/performance/server/xeon/index.htm. Results vary by hardware and software configuration.

SPECfp*_rate_base2000. Baseline System Configuration: Dell PowerEdge* 1425SC: Two 64-bit Intel® Xeon® processors 3.60 GHz with 2MB L2 Cache, 4x512MB (dual-ranked) DDR-2 DIMMs for RAM and Red Hat Enterprise Linux Update 2, Intel® EM64T, Binaries with Intel 8.1 EM64T Linux compilers Referenced as published at http://www.spec.org/cpu2000/results/res2005q1/cpu2000-20050207-03822.html. New Platform configuration: Intel internal measurement (September 2005). Intel® Server System "Coyote 2" with two Dual-Core Intel® Xeon® processors 2.80 GHz, Intel® E7520 Chipset, 800 MHz FSB; 8 GB DDR2-400 memory (8x1GB), Hyper-Threading Technology OFF; HWP and ASP enabled. OS: Red Hat Enterprise Linux EM64T. SPECcpu2000 binaries built with Intel compiler version 8.1.

Database: This Intel internal workload evaluates the capacity of a database server in supporting transaction processing. Simulates execution of user transactions against a database in an order-entry environment. Measured in transactions per second. Intel internal measurement (September 2005). Baseline platform Configuration: Intel® Server System "Coyote" with two 64-bit Intel® Xeon® processors 3.60 GHz with 2MB L2 Cache, Intel® E7520 Chipset, 800 MHz FSB; 16 GB DDR2-400 memory (8x2GB); Hyper Threading ON; HWP and ASP enabled; Microsoft Windows* Enterprise Server 2003, x86 Edition. New Platform configuration Intel® Server System "Coyote 2" with two Dual-Core Intel® Xeon® processors 2.80 GHz, Intel® E7520 Chipset, 800 MHz FSB; 16 GB DDR2-400 memory (8x2GB); Hyper-Threading Technology ON; HWP and ASP disabled. Microsoft Windows* Enterprise Server 2003, x86 Edition.

LS-Dyna* mpp970.5434a (3cars wkld@10ms, jobs/day), Star-CD* v3.22 (64-bit) (Engine wkld, jobs/day), Fluent* 6.2 (64-bit). Common system configuration for the above HPC applications. Intel internal measurement (September 2005). Baseline Platform Configuration: Intel® Server System "Coyote" with two 64-bit Intel® Xeon® processors 3.60 GHz with 2 MB L2 Cache, Intel® E7520 Chipset, 800 MHz FSB; 8 GB DDR2-400 memory (8x1GB); OS: Red Hat Enterprise Linux AS release 3 (Update 3) Linux version 2.4.21-20SMP, Intel® EM64T. New Platform configuration Intel® Server System "Coyote 2" with two Dual-Core Intel® Xeon® processors 2.80 GHz, Intel® E7520 Chipset, 800 MHz FSB; 8 GB DDR2-400 memory (8x1GB), OS: Red Hat Enterprise Linux AS release 4 (Nahant Update 1) Linux version 2.6.9-11.EL, Intel® EM64T.

Linpack: Intel internal measurement (September 2005). Baseline Platform configuration: Intel® Server System "Coyote" with two 64-bit Intel® Xeon® processors 3.60 GHz with 2MB L2 Cache, Intel® E7520 Chipset, 800 MHz FSB; 8 GB DDR2-400 memory (8x1GB); OS: Red Hat Enterprise Linux AS release 3 (Taroon Update 2) Linux version 2.4.21-12.EL, EM64T Intel LINPACK Workload Version: 2.1 for EM64T, Workload: 1Kx1K through 30Kx30K matrix sizes used; Workload Type: Scalar. New Platform configuration: Intel® Server System "Coyote 2" with two Dual-Core Intel® Xeon® processors 2.80 GHz, Intel® E7520 Chipset, 800 MHz FSB; 8 GB DDR2-400 memory (8x1GB); OS: Red Hat Enterprise Linux AS release 3 (Taroon Update 3) 2.4.21-20.EL x86_64 GNU/Linux, Intel® EM64T, Intel LINPACK Workload Version: 2.1.2 for Intel® EM64T, Workload: 1Kx1K through 30Kx30K matrix sizes used; Workload Type: Scalar.

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SPECint2000 and SPECfp2000 benchmark tests reflect the performance of the microprocessor, memory architecture and compiler of a computer system on compute-intensive, 32-bit applications. SPEC benchmark tests results for Intel microprocessors are determined using particular, well-configured systems. These results may or may not reflect the relative performance of Intel microprocessor in systems with different hardware or software designs or configurations (including compilers). Buyers should consult other sources of information, including system benchmarks; to evaluate the performance of systems they are considering purchasing.

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